reduced to a percentage basis and these relative frequencies summed from the beginning for each successive grade. The curves are merely draughtsman's curves smoothing the empirical frequencies, but for present purposes they are quite good enough.

From such curves one may read off at once the relative frequencies of pressures of different grades. Thus for the Cold Spring Harbor series fifty per cent. of the pressures are about 10.5 atmospheres or lower, whereas in the Desert series fifty per cent. of the pressures are 15.7 atmospheres or higher. In the Tucson series about thirty per cent. of the concentrations are the equivalent of over 20 atmospheres, whereas in the Cold Spring Harbor series only about three per cent. of the cases exceed this value.

Note also that in the Desert there is a higher maximum and a higher minimum than in the more mesophytic habitat. The range of variation is also far greater in the Tucson than in the Cold Spring Harbor series.

In using cryoscopic methods we have so far failed to find pressures so high as those recorded by Fitting. We are not, however, ready to suggest that they do not occur. Possibly our failure to demonstrate them in the Tucson region may be due to the fact that our determinations were carried out at the close of the winter and spring rainy season, and hence on plants which had not been subjected to the maximum dryness of the region in question during the growing season of the year in which the determinations were made.

J. Arthur Harris,
John V. Lawrence,
Ross Aitken Gortner

## On the Genus Trachodon[1]

In 1902 Mr. J. B. Hatcher published an article[2] entitled "The Genera and Species of the Trachodontidæ (Hadrosauridæ, Claosauridæ) Marsh," in which the conclusion was reached

> that the ten genera [of the Trachodontidæ] which have been proposed should be reduced to two. *Trachodon* Leidy and *Claosaurus* Marsh, while the remaining eight genera should be treated as synonyms of *Trachodon*, which should also be made to include *T.* (*Claosaurus*) *annectens* Marsh; while the smaller *Claosaurus agilis* described by Marsh from the Kansas chalks [Niobrara] may still be considered as pertaining to a distinct genus."

These conclusions were almost unanimously adopted by American vertebrate paleontologists in their subsequent work, and this general use of the term *Trachodon* has continued up to the present time.

The finding of more perfect material in recent years has shown that several of the species formerly referred to *Trachodon* represent distinct genera, and in the light of these discoveries Hatcher's reduction now appears to have been too radical, but he was probably correct in restricting *Claosaurus* to the single species from the Niobrara formation.

It is unfortunate, however, that this view of the genus *Trachodon*, which includes species from the Judith River formation to the close of the Lance, has become so widely accepted by paleontologists.

In the first place the type of the genus (*Trachodon mirabilis* Leidy) is from the Judith River formation and was founded upon inadequate material consisting of "specimens of teeth generally very much worn and in a fragmentary condition," so that it is quite impossible to identify positively with them better and subsequently discovered specimens.

That later Hatcher[3] appreciated this fact is clearly shown by the following extract:

> Although the trachodonts are easily distinguishable by their teeth from the other Dinosauria of these beds [Judith River] it is scarcely possible to identify the various species of this genus or the genera of the family from the teeth alone.

Even though it eventually be found that

cooling, by the use of tables already published. See Harris and Gortner, *Amer. Jour. Bot.*, 1: 1914.

[1] Published with the permission of the Director of the U. S. Geological Survey.

[2] *Annals of the Carnegie Museum*, Vol. I., 1902, pp. 377–386.

[3] T. W. Stanton and J. B. Hatcher, "Geology and Paleontology of the Judith River Beds," Bull. 257, U. S. Geol. Surv., 1905, pp. 96–97.

*Trachodon* can be placed on a sound footing, there is now reason for believing this genus is not present in the Lance formation, as indicated by the fewer number of teeth in all of the known specimens from the Judith River, Belly River and Two Medicine formations.

In the U. S. National Museum collections there are several complete dentaries of the Lance trachodonts in which the vertical rows of teeth vary from 52 to 57 in number. All of those in the collection from the other formations mentioned above have fewer rows, varying from 39 to 47. When it is known that each vertical row has from six to ten teeth, the difference in the total number is considerable.

The same condition prevails in the few maxillæ available. It thus seems that the earliest known trachodonts as in the more primitive Ceratopsians, have a smaller number of teeth, so that now it may be safely asserted that one of the marked phases in the specialization of the members of this group in successive geological periods is a progressive increase in the number of teeth in the dental magazines.

Since it is now known that the genus *Trachodon* is based upon specimens from the Judith River formation, and that all available trachodont material from that and equivalent formations shows a reduced dentition, this smaller number of teeth would in itself constitute a difference sufficient to restrict the genus *Trachodon* to species from the Judith River formation.

This difference I have no doubt will be augmented by other characters when sufficient material is obtained for comparison. I would therefore restrict the genus *Trachodon* to Judith River species.

This leaves the Lance trachodonts without generic designation, and it will on that account be necessary to revive one of the older generic terms, but I find that had been done before the appearance of Hatcher's article. In 1901[4] Lucas called attention to the identity of the type of *Thespesius occidentalis* Leidy with the homologous parts of *Claosaurus annectens* Marsh, and "that consequently this Dinosaur must be known by Leidy's name."

In 1902[5] Hay, upon the authority of Lucas, made *Claosaurus annectens* a synonym of *Thespesius occidentalis,* including under the same genus the Niobrara species *C. agilis,* but this proposed change in nomenclature has been entirely ignored by paleontologists in subsequent work.

I have recently compared the types of *Thespesius occidentalis* Leidy and *Claosaurus annectens* Marsh and can testify to the close similarity of the homologous bones. The inadequacy of the type material upon which *Thespesius* is based (two caudal centra and a proximal phalanx) is fully recognized, but that these pertain to a trachodont dinosaur there can be no doubt. It is now positively known from the geological mapping done in recent years, in the locality where this material was obtained, that the specimens came from the Lance formation on the Grand River in what is now the state of South Dakota. Despite the meagerness of the material upon which it is founded, it seems to me that *Thespesius,* being the older term, is the logical choice of names for the designation of the trachodont dinosaurs from the Lance formation.

While it can not be positively demonstrated that *occidentalis* and *annectens* are identical, it is equally true that they can not be shown to represent distinct species. Since the localities from which the type specimens came are not far apart geographically, it appears most probable, however, that they do represent one and the same species. I would therefore endorse the use of *Thespesius occidentalis* as first proposed by Lucas.

The chief points that I have attempted to bring out in the preceding lines may be summed up as follows:

1. That the trachodont dinosaurs of the Judith River and equivalent formations have fewer vertical rows of teeth in the jaws than those from the Lance.

2. That this feature constitutes a sufficient

[4] F. A. Lucas, "Paleontological Notes," SCIENCE (2), Vol. 12, 1900, p. 809.

[5] O. P. Hay, "Bibliography and Catalogue of the Fossil Vertebrates of North America," Bull. No. 179, U. S. Geol. Surv., 1901, pp. 502–503.

structural difference to separate generically all Judith River, Belly River and Two Medicine trachodonts from those obtained in the Lance formation, and that therefore the use of the term *Trachodon* should be restricted in its application to some one of those trachodonts found in the older beds.

3. That the restriction of the genus *Claosaurus* to the Niobrara species *C. agilis* Marsh first proposed by Hatcher be endorsed.

4. That *Claosaurus annectens* Marsh should be regarded as a synonym of *Thespesius occidentalis* Leidy as first proposed by Lucas.

CHARLES W. GILMORE
U. S. NATIONAL MUSEUM,
January, 1915

## THE SOCIETY OF AMERICAN BACTERIOLOGISTS. II

### *Technique*

Under the supervision of G. F. Ruediger

*The Bacteriological Work of the Bureau of Chemistry and Its Possibilities:* CHARLES THOM.

The papers presented by members of the bacteriological staff of the Bureau of Chemistry are fairly representative of the manner in which numerous problems arising from the enforcement of the Food and Drugs Act are being met by the bacteriological laboratory. Very many of the food products and other preparations met with in inspection work have not been adequately studied by bacteriologists. No analysis of the flora present in such substances is available. Standard methods for testing them have not been developed. The workers into whose hands they fall must then make a full study of several to many brands of the commercial article and very frequently follow the product every step of the way back to the actual producer before adequate data can be obtained to determine what action, if any, shall be taken by the bureau. The members of the Bacteriological Society are earnestly requested to aid this work whenever opportunity arises by studying the bacteriological conditions obtaining in food-stuffs and the standardization and publication of methods of procedure.

In addition to its inspection work, the bureau is now establishing a research laboratory to take up food deterioration, fermentation and technically bacteriological and mycological work upon unsolved problems concerning foods and drugs. This work will be carried in the closest possible cooperation with the chemical laboratories of the bureau dealing with the same related problems. By these two methods of attack it is hoped to enlarge our knowledge of the flora of food stuffs and the relation of these organisms to normal and abnormal conditions as found.

*Methods of Counting Bacteria:* ROBERT S. BREED.

Three methods of counting the number of bacteria present in various substances have been generally recognized. In order of their historical development, they are the microscopical method, the dilution method and the plating method. For the past few years, however, the latter method has been used, especially among American bacteriologists, almost to the exclusion of the others and this, in spite of the fact that what little comparative work has been done indicates that certain uncontrollable elements in this technique cause large errors.

Among other causes of irregularities in the counts, there are two which tend to lower the count in both the dilution and the plating method. One of these is the fact that the organisms present in the substance under examination may fail to grow in the culture medium used, and the other, that the clumping of the organisms reduces the number of centers from which growth occurs. The microscopical technique is free from these objections, but it is open to another in all cases where a count of living organisms only is desired. This objection arises because of the fact that it is ordinarily impossible to distinguish organisms which were alive at the time the preparation was made from those which were dead. This difficulty causes the count obtained in this way to be higher than it should be.

These conditions which have thus far proved to be uncontrollable in all of the three methods are largely responsible for the big discrepancies in the comparative counts which have been made. These discrepancies show most strikingly that all so-called bacterial counts are much better styled "estimates" than "counts." Statements that certain substances, such as milk, water, sewage and the like, contain such and such numbers of bacteria are particularly unfortunate, for they are plain misstatements of facts. In most cases the figures given represent counts of colonies on agar or gelatin and may be properly so recorded but these figures are usually far below the actual number of bacteria present.

So far as raw milk is concerned, microscopical methods of counting have been shown to have great usefulness, for, in these cases, the number of